Sumari

A. Documentació tècnica

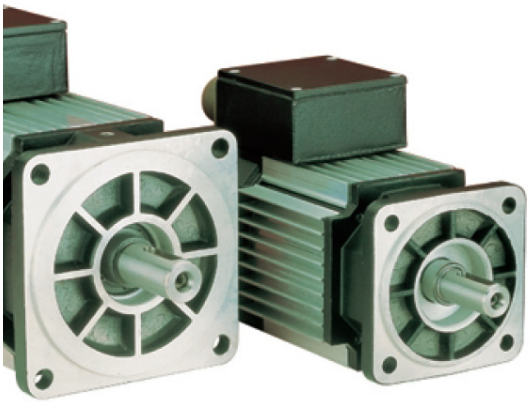
A.1. Servomotors MAVILOR

MAVILOR
INFRANOR GROUP COMPANY

AC Servo Motors
BL 110/140/190 Series

The BL Series are synchronous electrical servomotors, with 3 winding phases, supplied with Sinusoidal or Trapezoidal current wave forms. The Feed-Back devices that produce the synchronization signal and speed (position, also in the Sinusoidal case), are a Resolver (BLS Series) or a Hall effect devices (BLT Series). This "BRUSHLESS" technology provides:

- High dynamic response.
- Full speed condition, not limited by the "Brush Sparking effect".
- High thermal and dynamic characteristics, because of the motor's windings which are located in the stators.
- Very low maintenance.
- Connection box with four available positions from the standard construction.



BLS ~ Technical Specifications

ALL CHARACTERISTICS MEASURED AT 25° C AMBIENT TEMPERATURE	SYMBOLS	UNITS
MAX MECHANICAL SPEED	n	rpm
STALL TORQUE (1) ±10%	M_S	Nm
STALL CURRENT	I_S	A
PEAK TORQUE ±10%	M_J	Nm
TORQUE-WEIGHT RATIO	T_W	Nm/kg
EMF CONSTANT ±5%	K_E	Vs/rad
TORQUE CONSTANT ±5%	K_T	Nm/A
RELUCTANCE TORQUE (*)	T_R	Nm
WINDING RESISTANCE ±5%	R	Ω
WINDING INDUCTANCE ±5%	L	mH
ROTOR INERTIA	J	kg m^2 10^{-3}
MECHANICAL TIME CONSTANT	τ_M	ms
ELECTRICAL TIME CONSTANT	τ_E	ms
THERMAL TIME CONSTANT	τ_{TH}	s
THERMAL RESISTANCE	R_{TH}	°C/W
MASS	M	kg
RADIAL LOAD (at mid-length of shaft)	F_R	N
AXIAL LOAD	F_A	N
INSULATION		
PROTECTION		

(1) With an aluminium heat sink plate

(*) Respect to the Stall Torque

BLT ⌒ Technical Specifications

ALL CHARACTERISTICS MEASURED AT 25° C AMBIENT TEMPERATURE	SYMBOLS	UNITS
MAX MECHANICAL SPEED	n	rpm
STALL TORQUE (1) ±10%	M_S	Nm
STALL CURRENT	I_S	A
PEAK TORQUE ±10%	M_J	Nm
TORQUE-WEIGHT RATIO	T_W	Nm/kg
EMF CONSTANT ±5%	K_E	Vs/rad
TORQUE CONSTANT ±5%	K_T	Nm/A
RELUCTANCE TORQUE (*)	T_R	Nm
WINDING RESISTANCE ±5%	R	Ω
WINDING INDUCTANCE ±5%	L	mH
ROTOR INERTIA	J	kg m^2 10^{-3}
MECHANICAL TIME CONSTANT	τ_M	ms
ELECTRICAL TIME CONSTANT	τ_E	ms
THERMAL TIME CONSTANT	τ_{TH}	s
THERMAL RESISTANCE	R_{TH}	°C/W
MASS	M	kg
RADIAL LOAD (at mid-length of shaft)	F_R	N
AXIAL LOAD	F_A	N
INSULATION		
PROTECTION		

(1) With an aluminium heat sink plate

(*) Respect to the Stall Torque

ETSEIB

BLS-111		BLS-112		BLS-113		BLS-114		BLS-115	
220 VAC	400 VAC	220 VAC	400 VAC	220 VAC	400 VAC	220 VAC	400 VAC	220 VAC	400 VAC
8,500		8,500		8,500		8,500		8,500	
2.9	2.9	5.0	5.0	8.4	8.4	10.6	10.6	13.9	13.9
3.49	2.04	6.02	3.29	9.88	5.71	12.77	7.31	17.16	9.79
11.6	11.6	20.0	20.0	33.6	33.6	42.4	42.4	55.6	55.6
0.73	0.73	1.0	1.0	1.33	1.33	1.43	1.43	1.64	1.64
0.48	0.82	0.48	0.88	0.49	0.85	0.48	0.84	0.47	0.82
0.83	1.42	0.83	1,52	0.85	1.47	0.83	1.45	0.81	1.42
<3%		<3%		<3%		<3%		<3%	
7.2	20.6	2.4	7.1	1.3	3.79	0.8	2.58	0.6	1.84
10	31	4.8	13.2	2.7	8.5	1.9	5.8	1.5	5.1
0.2	0.2	0.38	0.38	0.56	0.56	0.74	0.74	0.93	0.93
3.61	3.54	2.29	2.02	1.75	1.70	1.49	1.57	1.47	1.47
1.39	1.5	2.0	1.86	2.08	2.24	2.38	2.25	2.5	2.77
2,520	2,520	1,910	1,910	2,260	2,260	2,510	2,510	3,700	3,700
0.65	0.67	0.66	0.75	0.45	0.46	0.44	0.42	0.32	0.33
4	4	5	5	6.3	6.3	7.4	7.4	8.5	8.5
515		515		515		515		515	
255		255		255		255		255	
CLASS-F		CLASS-F		CLASS-F		CLASS-F		CLASS-F	
IP-65		IP-65		IP-65		IP-65		IP-65	
400x400x10									

BLS-141		BLS-142		BLS-143		BLS-144	
220 VAC	400 VAC	220 VAC	400 VAC	220 VAC	400 VAC	220 VAC	400 VAC
6,500		6,500		6,500		6,500	
13.6	13.6	17.4	17.4	26.8	26.8	33	33
13.6	7.01	15.4	8.02	19.14	10.19	17.55	9.38
54.4	54.4	69.6	69.6	107.2	107.2	132.0	132.0
1.3	1.3	1.41	1.41	1.63	1.63	1.64	1.64
0.58	1.12	0.65	1.25	0.81	1.52	1.09	2.03
1	1.94	1.13	2.17	1.4	2.63	1.88	3.52
<2.5%		<2.5%		<2.5%		<2.5%	
0.86	2.9	0.73	2.46	0.63	2.04	0.74	2.5
2.8	11.5	2.6	9	2.7	9.6	3.2	11
1.71	1.71	2.34	2.34	3.34	3.34	4.59	4.59
2.54	2.28	2.33	2.12	1.86	1,70	1.66	1.61
3.26	3.97	3.56	3.66	4.29	4.71	4.32	4.4
3,740	3,740	4,500	4,500	4,626	4,626	4,800	4,800
0.36	0.40	0.33	0.36	0.25	0.27	0.25	0.26
10.5	10.5	12.3	12.3	16.4	16.4	20.1	20.1
784		784		784		784	
343		343		343		343	
CLASS-F		CLASS-F		CLASS-F		CLASS-F	
IP-65		IP-65		IP-65		IP-65	
700x700x20							

BLS-191	BLS-192
400 VAC	400 VAC
2,800	
56	82
25.11	34.60
224.0	328.0
1.9	2.1
1.29	1.37
2.23	2.37
<2%	
0.39	0.26
1.9	1.5
14.7	22
1.99	1.76
4.87	5.77
4,400	4,090
0.23	0.18
29.5	39
1,400	
690	
CLASS-F	
IP-65	
700x700x20	

BLT-111		BLT-112		BLT-113		BLT-114		BLT-115	
220 VAC	400 VAC	220 VAC	400 VAC	220 VAC	400 VAC	220 VAC	400 VAC	220 VAC	400 VAC
8,500		8,500		8,500		8,500		8,500	
2.9	2.9	5.0	5.0	8.4	8.4	10.6	10.6	13.9	13.9
4.33	2.5	7.46	4.03	12.17	7.0	15.82	8.98	21.06	11.98
11.6	11.6	20.0	20.0	33.6	33.6	42.4	42.4	55.6	55.6
0.73	0.73	1.01	1.01	1.34	1.34	1.44	1.44	1.64	1.64
0.67	1.16	0.67	1.24	0.69	1.2	0.67	1.18	0.66	1.16
0.67	1.16	0.67	1.24	0.69	1.2	0.67	1.18	0.66	1.16
<3%		<3%		<3%		<3%		<3%	
7.2	20.6	2.4	7.1	1.3	3.79	0.8	2.58	0.6	1.84
10	31	4.8	13.2	2.7	8.5	1.9	5.8	1.5	5.1
0.2	0.2	0.38	0.38	0.56	0.56	0.74	0.74	0.93	0.93
3.21	3.06	2.03	1.75	1.53	1.47	1.32	1.37	1.28	1.27
1.39	1.5	2.0	1.86	2.08	2.24	2.38	2.25	2.5	2.77
2,520	2,520	1,910	1,910	2,260	2,260	2,510	2,510	3,700	3,700
0.64	0.67	0.64	0.75	0.45	0.46	0.43	0.41	0.32	0.33
3.97	3.97	4.97	4.97	6.27	6.27	7.37	7.37	8.47	8.47
515		515		515		515		515	
255		255		255		255		255	
CLASS-F		CLASS-F		CLASS-F		CLASS-F		CLASS-F	
IP-65		IP-65		IP-65		IP-65		IP-65	
400x400x10									

BLT-141		BLT-142		BLT-143		BLT-144	
220 VAC	400 VAC	220 VAC	400 VAC	220 VAC	400 VAC	220 VAC	400 VAC
6,500		6,500		6,500		6,500	
13.6	13.6	17.4	17.4	26.8	26.8	33	33
16.59	8.61	18.91	9.89	23.51	12.47	21.43	11.5
54.4	54.4	69.6	69.6	107.2	107.2	132.0	132.0
1.3	1.3	1.42	1.42	1.64	1.64	1.64	1.64
0.82	1.58	0.92	1.76	1.14	2.15	1.54	2.87
0.82	1.58	0.92	1.76	1.14	2.15	1.54	2.87
<2.5%		<2.5%		<2.5%		<2.5%	
0.86	2.9	0.73	2.46	0.63	2.04	0.74	2.5
2.8	11.5	2.6	9	2.7	9.6	3.2	11
1.71	1.71	2.34	2.34	3.34	3.34	4.59	4.59
2.19	1.99	2.02	1.86	1.62	1,47	1.43	1.39
3.26	3.97	3.56	3.66	4.29	4.71	4.32	4.4
3,740	3,740	4,500	4,500	4,626	4,626	4,800	4,800
0.36	0.4	0.33	0.36	0.25	0.27	0.25	0.26
10.47	10.47	12.27	12.27	16.37	16.37	20.7	20.7
784		784		784		784	
343		343		343		343	
CLASS-F		CLASS-F		CLASS-F		CLASS-F	
IP-65		IP-65		IP-65		IP-65	
700x700x20							

BLT-191	BLT-192
400 VAC	400 VAC
2,800	
56	82
30.43	42.49
224.0	328.0
1.9	2.1
1.84	1.93
1.84	1.93
<2%	
0.39	0.26
1.9	1.5
14.7	22
1.69	1.54
4.87	5.77
4,400	4,090
0.24	0.18
29.47	38.97
1,400	
690	
CLASS-F	
IP-65	
700x700x20	

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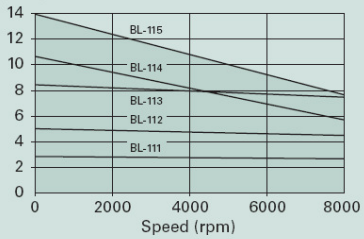
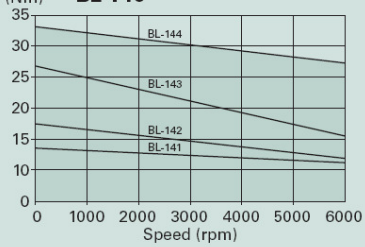
AC Servo Motors
BL 110/140/190 Series

Performance Curves

Torque (Nm) **BL-110**



Torque (Nm) **BL-140**



Torque (Nm) **BL-190**

The BL Series incorporates the option of a fail-safe holding brake within the structure of the motor.

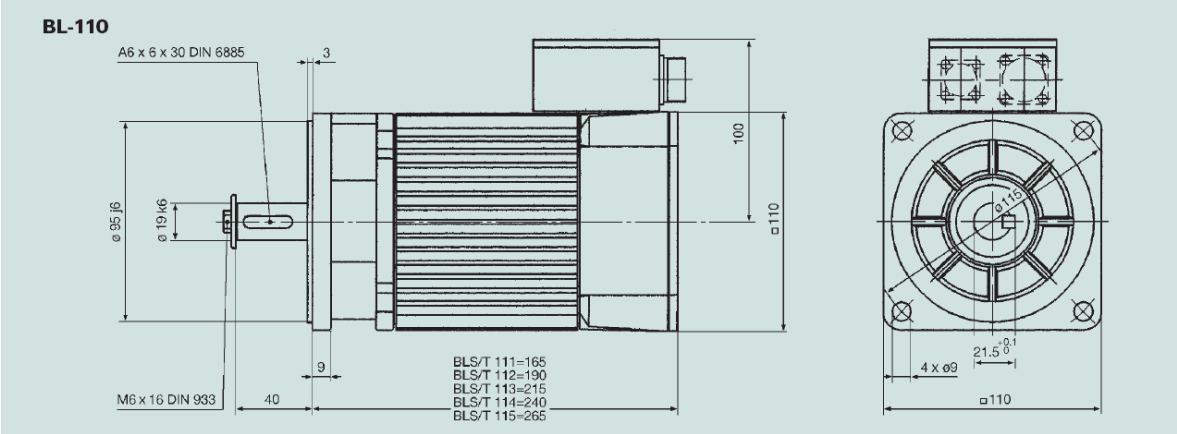
Resolver Specifications

	UNITS	2T8 (Transmitter Speed 1)
Input Voltage/Frecuency	V/kHz	10/4.5
Primary Element		Rotor
Number of Speed		1X
Transformation Ratio		0.5 ± 5%
Electrical Error	minutes	±10 max.
Dielectric Strength	VAC/1 minute	500
Mass	kg	0.230
Rotor Moment of Inertia	kg m^2 10^{-3}	0.0123
Operating Temperature Range	°C	-55 ~ +155

Brake Specifications

	SIZE	TORQUE Nm	INERTIA kg cm^2	MASS kg
BL-111 / 112	10	8	0.30	0.8
BL-113 / 114 / 115	10	12	0.30	0.8
BL-141 / 142 / 143 / 144	11	20	9.5	1.9
BL-191 / 192	09	72	16	2.85

ETSEIB


BL-110
A6 x 6 x 30 DIN 6885
3
ø 95 j6
ø 19 k6
100
□110
9
M6 x 16 DIN 933
40
BLS/T 111=165
BLS/T 112=190
BLS/T 113=215
BLS/T 114=240
BLS/T 115=265
ø115
21.5 +0.1 0
4 x ø9
□110

ETSEIB

A.2. Cargols de recirculació de boles i suports THOMSON

FineLine Rolled Ball Screws — Metric Series

FineLine Rolled Ball Screw Assemblies are designed and manufactured to provide high level performance at an affordable price. Ball screws are manufactured using Thomson's patented, German-engineered Precision Screw Forming (PSF) Technology, which provides high accuracy (23 microns/300mm standard) with the manufacturing efficiency of rolled processes. Ball nuts are manufactured with one of two ball return systems (button or end return) made with reinforced steel, making them extremely durable and ideal for high speed, high load, and/or high temperature applications. Each nut comes standard with an integral plastic wiper to protect against chips or other debris. FineLine Rolled Ball Screws are ideal for machining centers, factory automation, packaging, and injection molding applications.

Need a quote or have a question about an application? Contact us in North America at:

Phone: 540-633-3549
Fax: 540-639-4162
Email: thomson@danahermotion.com

ETSEIB

FineLine Rolled Ball Screws — FK/FH Style Ball Nuts

Standard Lead Accuracy: ± 23µm/300mm[1]

FK Style Nut

FH Style Nut

Internal Return Flanged Ball Nut and Screw

- Two nut styles (FK & FH) provide optimal performance in low and high lead assemblies
- Integral wiper and flange included as standard
- Available in three preload classes (Type Z1, Z2, Z3)
  Z1 – light preload to 1-2%
  Z2 – no preload, clearance held to max .18mm
  Z3 – no preload, clearance held to max .05mm

Nominal Diameter (size)	Lead	Nut Type	Ball Screw P/N[2][3][6]	Ball Nut P/N	Available Preload Types	Performance Data					Screw Specifications[4]			
				Type Z2 Standard		Dynamic Load Capacity (C_{am})		Static Load Capacity (C_o)		Max. Axial Backlash	Major Diameter	Minor Diameter	Max. Length[5]	Screw Weight
(mm)	(mm)					(kN)	(lbf)	(kN)	(lbf)	(mm)	(mm)	(mm)	(mm)	(kg/m)
12	5	FK	**7832772-T7**	**7832773**	Z1, Z2, Z3	5.6	1,259	6.2	1,393	0.07	11.6	9.7	3000	0.7
16	5	FK	**7832776-P5**	**7832777**	Z1, Z2, Z3	9.5	2,136	10.9	2,450	0.09	15.6	12.7	3000	1.2
20	5	FK	**7832779-P5**	**7832780**	Z1, Z2, Z3	11.5	2,585	15.5	3,485	0.09	19.6	16.7	4000	2.0
20	20	FH	**7832783-P5**	**7832784**	Z2, Z3	10.8	2,428	18.6	4,181	0.08	19.6	16.7	4000	1.9
25	5	FK	**7832786-P5**	**7832787**	Z1, Z2, Z3	13.1	2,945	20.2	4,541	0.09	24.6	21.7	5000	3.3
25	10	FH	**7832790-P5**	**7832791**	Z2, Z3	22.9	5,148	141.2	31,743	0.09	24.6	21.7	5000	3.3
25	25	FH	**7832793-P5**	**7832794**	Z2, Z3	13.1	2,945	26.0	5,845	0.08	24.6	22.0	5000	3.3
32	5	FK	**7832795-P5**	**7832796**	Z1, Z2, Z3	19.3	4,339	36.3	81,606	0.09	31.6	28.7	6000	5.6
32	10	FK	**7832798-P5**	**7832799**	Z1, Z2, Z3	26.4	5,935	39.0	8,768	0.15	31.6	27.1	6000	5.3
32	20	FH	**7832802-P5**	**7832803**	Z2, Z3	47.2	10,611	83.2	18,704	0.15	31.6	27.1	6000	5.3
32	32	FH	**7833301-P5**	**7833300**	Z2, Z3	19.7	4,429	37.4	8,408	0.08	31.3	28.3	6000	5.3
40	5	FK	**7832804-P5**	**7832805**	Z1, Z2, Z3	26.3	5,912	59.2	13,309	0.09	39.6	36.7	6000	9.0
40	10	FK	**7832808-P5**	**7832809**	Z1, Z2, Z3	64.9	14,590	109.0	24,504	0.18	39.6	34.0	6000	8.3
40	20	FH	**7832811-P5**	**7832812**	Z2, Z3	52.2	11,735	103.6	23,290	0.15	39.6	35.2	6000	7.6
40	40	FH	**7832814-P5**	**7832815**	Z2, Z3	59.7	13,421	108.9	24,482	0.18	39.6	34.0	6000	8.4
50	10	FK	**7832817-P5**	**7832818**	Z1, Z2, Z3	66.4	14,927	134.3	30,192	0.18	49.5	43.0	6000	13.5
50	20	FH	**7832820-P5**	**7832821**	Z2, Z3	78.8	17,715	188.7	42,421	0.16	49.5	44.6	6000	13.6
63	10	FK	**7832822-P5**	**7832823**	Z1, Z2, Z3	93.8	21,087	229.7	51,639	0.18	62.5	56.9	6000	22.0
63	20	FH	**7832825-P5**	**7832826**	Z2, Z3	103.1	23,178	270.8	60,878	0.18	62.5	56.9	6000	22.0
80	10	FK	**7832827-T7**	**7832828**	Z1, Z2, Z3	121.9	27,404	374.9	84,281	0.18	79.5	73.9	6000	36.4
80	20	FK	**7832830-T7**	**7832831**	Z2, Z3	176.4	39,700	375.0	84,300	0.18	79.5	69.9	6000	36.4

(1) 12mm and 80mm nominal diameter screws are ± 52µm/300mm.

(2) FineLine Ball Screws, Ball Nuts and End Blocks can be sold together as assemblies or separately as components (preloaded ball nuts sold only as an assembly).

(3) All ball screws and nuts are right-hand thread.

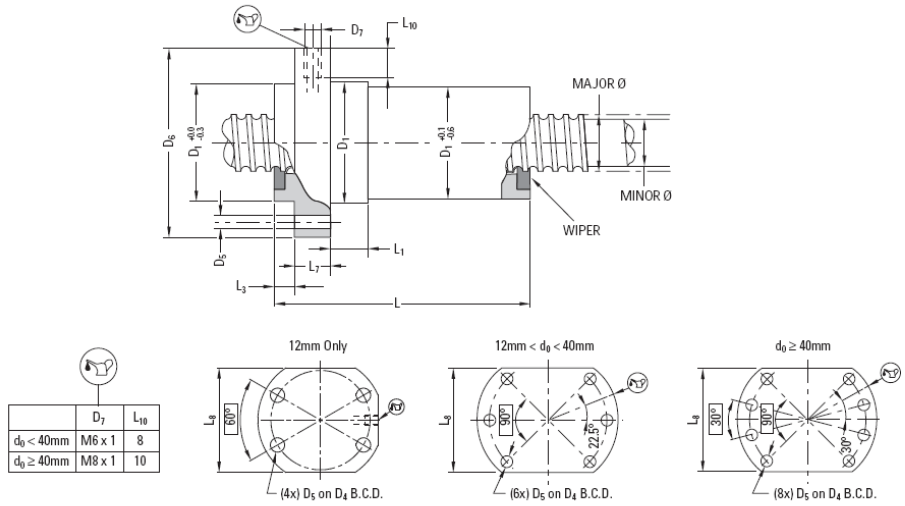
(4) Dimensional information on bearing supports and standard end machining is available on page 160.

(5) Max. length includes 150mm on each end usable for end machining only. Max. travel length equals table value minus 300mm. Ends are hardened.

(6) -P5 Accuracy Class is ±23µm/300 mm. -T7 Accuracy Class is ±52 µm/300 mm

ETSEIB

FineLine Rolled Ball Screws — FK/FH Style Ball Nuts



	D_7	L_{10}
d_0 < 40mm	M6 x 1	8
d_0 ≥ 40mm	M8 x 1	10

Nominal Diameter (size)	Lead	Nut Specifications (mm)										
		D_1	D_4	D_5	D_6	L	L_1	L_3	L_7	L_8	Nut Weight	Ball Diameter
(mm)	(mm)	g6		H13	h13				h13	h13	(kg)	(mm)
12	5	24.0	32.0	4.6	40.0	46.5	10.0	5.5	8.0	26.0	0.1	2.381
16	5	28.0	38.0	5.5	48.0	48.5	10.0	5.5	10.0	40.0	0.3	3.500
20	5	36.0	47.0	6.6	58.0	48.5	10.0	5.5	10.0	44.0	0.4	3.500
20	20	36.0	47.0	6.6	58.0	36.0	4.0	11.0	10.0	44.0	0.5	3.500
25	5	40.0	51.0	6.6	62.0	49.0	10.0	6.0	10.0	48.0	0.4	3.500
25	10	40.0	51.0	6.6	62.0	51.0	9.0	16.0	10.0	48.0	0.5	3.500
25	25	40.0	51.0	6.6	62.0	39.0	9.0	10.0	10.0	48.0	0.6	3.500
32	5	50.0	65.0	9.0	80.0	57.0	10.0	6.0	12.0	62.0	0.7	3.500
32	10	50.0	65.0	9.0	80.0	73.0	16.0	6.0	12.0	62.0	0.8	5.556
32	20	56.0	71.0	9.0	86.0	83.0	25.0	19.0	22.0	68.0	1.4	5.556
32	32	56.0	71.0	9.0	86.0	42.0	12.0	9.0	12.0	68.0	0.8	3.969
40	5	63.0	78.0	9.0	93.0	66.0	10.0	7.0	14.0	70.0	1.2	3.500
40	10	63.0	78.0	9.0	93.0	88.5	16.0	7.0	14.0	70.0	1.4	7.144
40	20	63.0	78.0	9.0	93.0	83.0	25.0	19.5	14.0	70.0	1.6	5.556
40	40	70.0	85.0	9.0	100.0	104.0	25.0	21.0	14.0	77.0	2.4	7.144
50	10	75.0	93.0	11.0	110.0	92.0	16.0	7.0	16.0	85.0	2.0	7.144
50	20	75.0	93.0	11.0	110.0	85.0	16.0	22.0	16.0	85.0	2.2	6.400
63	10	90.0	108.0	11.0	125.0	103.5	16.0	7.0	18.0	95.0	3.0	7.144
63	20	95.0	115.0	13.5	135.0	86.0	18.0	24.0	20.0	100.0	3.8	7.144
80	10	105.0	125.0	13.5	145.0	121.0	16.0	9.0	20.0	110.0	3.9	7.144
80	20	125.0	145.0	13.5	165.0	160.5	25.0	9.0	25.0	130.0	3.9	7.144

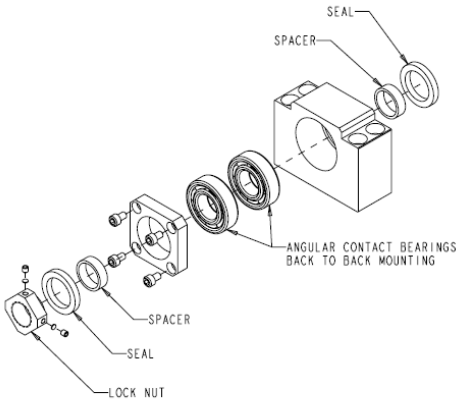
ETSEIB

Bearing Supports/End Machining Product Overview

Thomson Bearing Supports — complete package for simple mounting of Thomson ball screw and ball spline assemblies. Flange and Base mounts available with dual angular contact bearings or floating radial bearing.

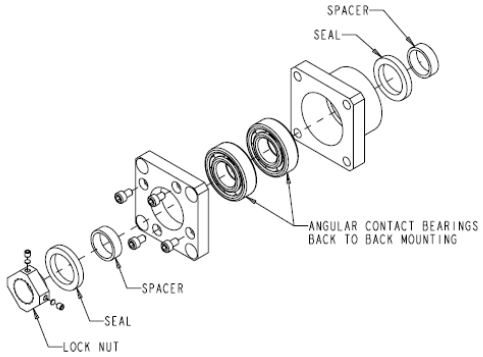
- Rugged steel construction
- Low profile, compact design
- Base or Flange mounting configurations
- Pre-assembled and ready for installation
- Available off-the-shelf

BK Bearing Support[1][2]



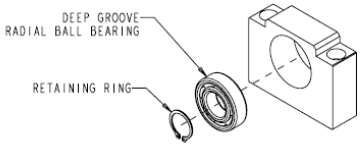
The base mounted BK Bearing Support contains an angular contact bearing pair arranged back-to-back (DB) for increased stiffness and axial load capacity. Design dimensions fit standard Type BK or BK1 end machining.

FK Bearing Support[1][2]



The flange mounted FK Bearing Support contains an angular contact bearing pair arranged back-to-back (DB) for increased stiffness and axial load capacity. Design dimensions fit standard Type FK or FK1 end machining.

BF Bearing Support[1][3]



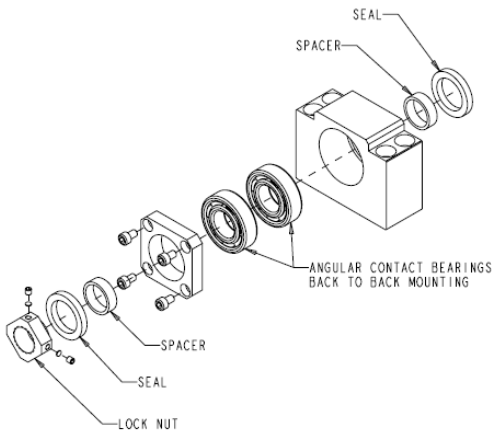
The base mounted BF Bearing Support contains a floating radial bearing to allow axial shaft movement. Design dimensions fit standard Type BF or BF1 end machining.

FF Bearing Support[1][3]

The flange mounted FF Bearing Support contains a floating radial bearing to allow axial shaft movement. Design dimensions fit standard Type FF or FF1 end machining.

Bearing Supports/End Machining — Metric Series Ball Screws

BK Support Blocks

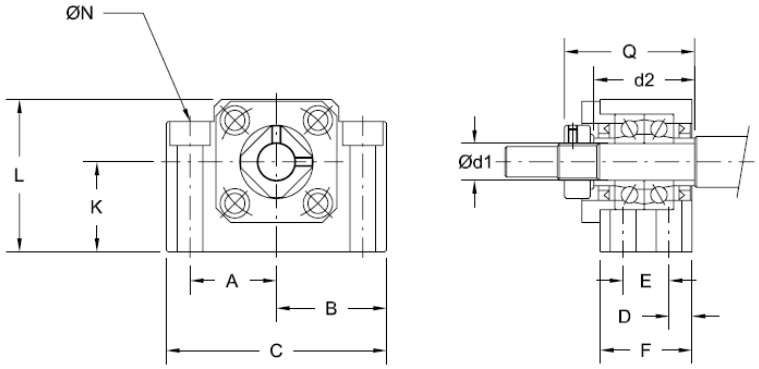


Standard P/N	Dia.x Lead (inch)	Bearing Rating				Lock Nut Type	Bearing Block Weight (kg)
		Static Rating C_o		Dynamic Rating C_{am}			
		(lbs)	(N)	(lbs)	(N)		
7833391	12	326	1450	989	4400	RN10	0.4
7833392	16	627	2790	1596	7100	RN12	0.5
7833393	20	1057	4700	2315	10300	RN15	0.6
7833394	25	1832	8150	3215	14300	RN20	1.3
7833395	32	2113	9400	3732	16600	RN25	2.4
7833396	40	3035	13500	5170	23000	RN30	3.4
7833397	50	6789	30200	11375	50600	RN40	6.8

Note: Design dimensions fit standard Type BK and BK1 end machining. See page 172 for details.

ETSEIB

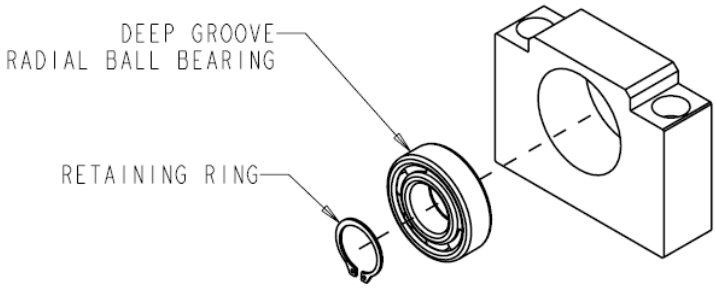
BK Bearing Support Blocks



Standard P/N	Bearing Block Dimensions (mm)											
	d1	d2	A	B	C	D	E	F	K ±0.02	L	N	Q
7833391	10	27.0	23.0	30.0	60.0	6.0	13.0	25.0	22.00	39.0	4 Holes 6.6 dia Thru 10.8 C-Bore x 5.0 Deep	34.0
7833392	12	27.0	23.0	30.0	60.0	6.0	13.0	25.0	25.00	43.0	4 Holes 6.6 dia. Thru 10.8 C-Bore x 1.5 Deep	34.0
7833393	15	30.0	27.0	35.0	70.0	6.0	15.0	27.0	28.00	48.0	4 Holes 6.6 dia. Thru 11.0 C-Bore x 6.5 Deep	38.0
7833394	20	40.0	35.0	44.0	88.0	8.0	19.0	35.0	34.00	60.0	4 Holes 9.0 dia. Thru 14.0 C-Bore x 8.5 Deep	51.0
7833395	25	48.0	42.5	53.0	106.0	10.0	22.0	42.0	48.00	80.0	4 Holes 11.0 dia. Thru 17.0 C-Bore x 11.0 Deep	63.0
7833396	30	50.0	51.0	64.0	128.0	11.0	23.0	45.0	51.00	89.0	4 Holes 14.0 dia. Thru 20.0 C-Bore x 13.0 Deep	70.0
7833397	40	66.0	65.0	80.0	160.0	14.0	33.0	61.0	60.00	110.0	4 Holes 18.0 dia. Thru 26.0 C-Bore x 17.5 Deep	91.0

Bearing Supports/End Machining — Metric Series Ball Screws

BF Support Blocks

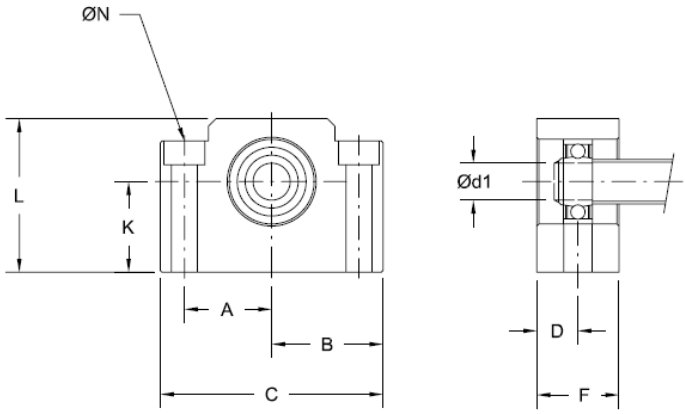


Standard P/N	Dia.x Lead (mm)	Bearing Rating				Snap Ring (DIN 471) (mm)	Bearing Block Weight (mm)
		Static Rating C_o		Dynamic Rating C_{am}			
		(lbs)	(N)	(lbs)	(N)		
7833398	12	366	1630	821	3650	8	0.3
7833399	16	674	3000	1708	7600	10	0.4
7833400	20	780	3470	1945	8650	15	0.4
7833401	25	1461	6500	3237	14400	20	0.8
7833402	32	1753	7800	3597	16000	25	1.5
7833403	40	2540	11300	4991	22200	30	2.0
7833404	50	5822	25900	11375	50600	40	3.3

Note: Design dimensions fit standard Type BF and BF1 end machining. See page 172 for details.

ETSEIB

BF Bearing Support Blocks

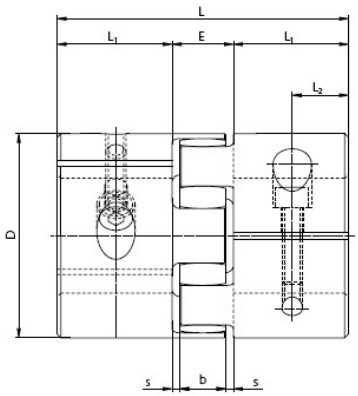


Standard P/N	Bearing Block Dimensions (mm)								
	d1 (mm)	A	B	C	D	F	K ±0.02	L	N
7833398	8	23.0	30.0	60.0	10.0	20.0	22.00	39.0	2 Holes 6.6 dia Thru 10.8 C-Bore x 5.0 Deep
7833399	10	23.0	30.0	60.0	10.0	20.0	25.00	43.0	2 Holes 6.6 dia. Thru 10.8 C-Bore x 1.5 Deep
7833400	15	27.0	35.0	70.0	10.0	20.0	28.00	48.0	2 Holes 6.6 dia. Thru 11.0 C-Bore x 6.5 Deep
7833401	20	35.0	44.0	88.0	13.0	26.0	34.00	60.0	2 Holes 9.0 dia. Thru 14.0 C-Bore x 8.5 Deep
7833402	25	42.5	53.0	106.0	15.0	30.0	48.00	80.0	2 Holes 11.0 dia. Thru 17.0 C-Bore x 11.0 Deep
7833403	30	51.0	64.0	128.0	16.0	32.0	51.00	89.0	2 Holes 14.0 dia. Thru 20.0 C-Bore x 13.0 Deep
7833404	40	65.0	80.0	160.0	18.5	37.0	60.00	110.0	2 Holes 18.0 dia. Thru 26.0 C-Bore x 17.5 Deep

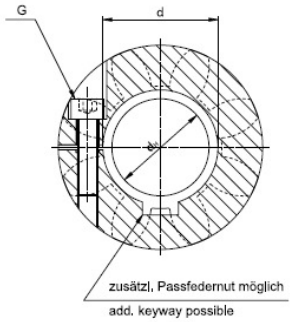
A.3. Acoblaments DELTA

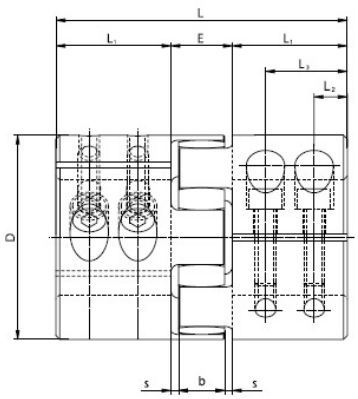
DELTA Antriebstechnik

DELTEX S-KN Drehelastische Wellenkupplung mit Klemmnabe - Stahlausführung
DELTEX S-KN Torsionally Flexible Shaft Coupling with Clamping Hub - Made of Steel



DELTEX S-KN Gr. 19-48
DELTEX S-KN Type 19-48





DELTEX S-KN Gr. 55-90
DELTEX S-KN Type 55-90

DELTEX S-KN A Baugröße *Type*	Fertigbohrungen *Finish bore* min. Ø d [mm]	max. Ø d [mm]	Abmessungen *Dimensions* [mm] Ø D	L	L_1	L_2	L_3	E	s	b	Ø d_H	ISO 4762 G
19	6	24	40	66	25	13	–	16	2	12	18	M6x16
24	8	28	55	78	30	18	–	18	2	14	27	M6x20
28	10	38	65	90	35	21	–	20	2,5	15	30	M8x25
38	12	45	80	114	45	26	–	24	3	18	38	M8x30
42	14	55	95	126	50	32	–	26	3	20	46	M10x35
48	15	60	105	140	56	35	–	28	3,5	21	51	M12x40
55	20	70	120	160	65	14	25	30	4	22	60	M12x45
65	22	80	135	185	75	14	28	35	4,5	26	68	M12x45
75	30	90	160	210	85	17	32	40	5	30	80	M16x50
90	40	100	200	245	100	20	40	45	5,5	34	100	M20x60

Die jeweils übertragbaren Momente sind vom Bohrungsdurchmesser abhängig.
Transmittable torques depend on the bore diameter.

Es sind 2 Ausführungen von Klemmnaben möglich:
2 designs are possible:

Ausführung 0 =
Klemmnabe ohne Passfedernut
Design 0 =
Clamping hub without keyway

Ausführung 1 =
Klemmnabe mit Passfedernut
Design 1 =
Clamping hub with keyway

ETSEIB

A.4. Rails i coixinets THOMSON

Thomson RoundRail Linear Guides and Components

Selection Guide for Inch and Metric Linear Ball Bushing Bearings, 60 Case Shafting and RoundRail Linear Guides

THOMSON™
Linear Motion. ***Optimized.***

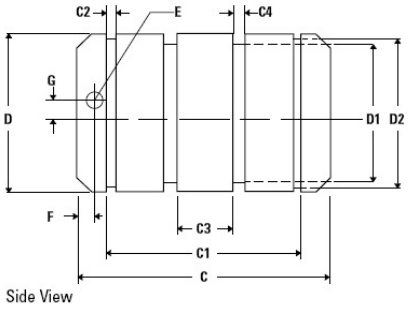
ETSEIB

Inch – FluoroNyliner Bushing Bearings

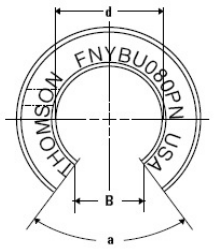
Common Open Bearing Dimensions (in.)

Nominal Bearing Diameter (in.)	E	F	G	B	a (*)
.250	.094	.375	.000	.188	60
.375	.094	.438	.000	.250	60
.500	.136	.625	.000	.313	66
.625	.104	.125	.000	.375	60
.750	.136	.125	.000	.438	66
1.000	.136	.125	.000	.563	64
1.250	.201	.197	.000	.625	60
1.500	.201	.193	.000	.750	60
2.000	.265	.292	.000	1.000	60

Open Bearing



Side View



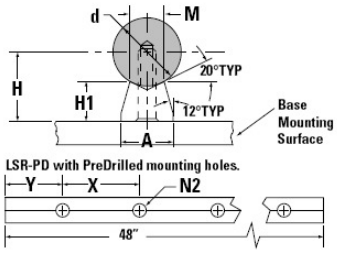
Front View

Standard Open Bearings

Precision I.D.			Compensated I.D. [1]				Open Bearing Dimensions (in.)								
Part Number	d (in.)		Part Number	d (in.)		Nom. Bearing Dia.	D		D1	D2	C		C1 Min.	C2 Min.	C3	C4
	Min.	Max.		Min.	Max.		Min.	Max.			Min.	Max.				
FNYBU-04-OPN	.2510	.2520	FNYBU-04-L-OPN	.2530	.2540	.250	.4990	.5000	.399	.467	.735	.750	.519	.041	.125	.080
FNYBU-06-OPN	.3760	.3770	FNYBU-06-L-OPN	.3780	.3790	.375	.6240	.6250	.524	.596	.860	.875	.634	.041	.187	.080
FNYBU-08-OPN	.5010	.5020	FNYBU-08-L-OPN	.5030	.5040	.500	.8740	.8750	.712	.833	1.235	1.250	.956	.046	.250	.125
FNYBU-10-OPN	.6260	.6270	FNYBU-10-L-OPN	.6280	.6290	.625	1.1240	1.1250	.962	1.070	1.485	1.500	1.101	.056	.312	.125
FNYBU-12-OPN	.7510	.7520	FNYBU-12-L-OPN	.7540	.7550	1.750	1.2490	1.2500	1.187	1.195	1.610	1.625	1.163	.056	.312	.125
FNYBU-16-OPN	1.0010	1.0020	FNYBU-16-L-OPN	1.0040	1.0050	1.000	1.5614	1.5625	1.402	1.490	2.235	2.250	1.745	.068	.500	.125
FNYBU-20-OPN	1.2510	1.2520	FNYBU-20-L-OPN	1.2550	1.2560	1.250	1.9990	2.0000	1.837	1.889	2.605	2.625	2.015	.070	.625	.125
FNYBU-24-OPN	1.5010	1.5022	FNYBU-24-L-OPN	1.5050	1.5062	1.500	2.3740	2.3750	2.152	2.265	2.985	3.000	2.402	.086	.750	.165
FNYBU-32-OPN	2.0010	2.0024	FNYBU-32-L-OPN	2.0060	2.0074	2.000	2.9990	3.0000	2.775	2.860	3.985	4.000	3.180	.103	1.000	.188

ETSEIB

Type LSR and LSR-PD 60 Case LinearRace Support Rails (Dimensions in inches)



Material: Steel Alloy
(Longer Lengths are Available)

LSR Standard Without Holes	LSR-PD Standard w/PreDrilled Holes	Nominal LinearRace Diameter d	H ±.002	H1	A	M	N2	N1	X	Y	Weight lb/ft
							Hole	Bolt			
LSR-8	LSR-8-PD	.500	.562	.34	.37	.25	.17	#6-32	4	2	.32
LSR-10	LSR-10-PD	.625	.687	.41	.45	.31	.19	#8-32	4	2	.49
LSR-12	LSR-12-PD	.750	.750	.42	.51	.38	.22	#10-32	6	3	.59
LSR-16	LSR-16-PD	1.000	1.000	.56	.69	.50	.28	1/4-20	6	3	1.01
LSR-20	LSR-20-PD	1.250	1.187	.63	.78	.56	.34	5/16-18	6	3	1.27
LSR-24	LSR-24-PD	1.500	1.375	.70	.93	.69	.41	3/8-16	8	4	1.68
LSR-32	LSR-32-PD	2.000	1.750	.845	1.180	.875	.531	1/2-13	8	4	2.59
LSR-40	LSR-40-PD	2.500	2.250	1.125	1.500	1.125	.687	5/8-11	8	4	4.48
LSR-48	LSR-48-PD	3.000	2.750	1.404	1.875	1.375	.812	3/4-10	8	4	6.68
LSR-64	LSR-64-PD	4.000	3.500	1.750	2.500	1.875	1.060	1-8	8	4	11.8

A.5. Sensors final de carrera OMRON

OMRON

High-Precision Switch | D5A

High-Precision Switch for Detecting Micron Unit Displacement

- 1-micron or 3-micron repeat accuracy
- Ideal for detecting and measuring wear of cutting tools or the original point of work
- 24 VDC solid state output or 12 VDC/ 24 VAC contact output
- Solid state output model has LED indicator for ease of monitoring operation
- M16 and limit switch body types available with M12 quick disconnect for easy installation and maintenance

Ordering Information

■ SWITCH

Contact Output Models (Without Operation Indicator)

Actuator	Body Type	Repeat accuracy	Operating force	Cable lead outlet		Degree of protection	Part number
				Type	Length		
Pin plunger	M5	1 µm max.	0.29 N max.	Prewired	1 m	IP40	D5A-1100
			0.49 N max.				D5A-1200
		3 µm max.	0.29 N max.				D5A-2100
			0.49 N max.				D5A-2200
	M8	1 µm max.	0.49 N max.			IP67	D5A-3200
			0.98 N max.				D5A-3300
	M16	3 µm max.	2.45 N max.				D5A-7400
				Connector			D5A-7403

Solid-State PNP Output Models (With Operation Indicator)

Actuator	Body Type	Repeat accuracy	Operating force	Cable lead outlet		Degree of protection	Part number
				Type	Length		
Pin plunger	M8	1 µm max.	0.49 N max.	Prewired	1 m	IP67	D5A-3210
			0.98 N max.				D5A-3310
	Slim		0.49 N max.				D5A-5210
			0.98 N max.				D5A-5310
	M16	3 µm max.	2.45 N max.				D5A-7410
				Connector			D5A-7413
Top plunger	Limit	3 µm max.	3.92 N max.	Prewired	3 m		D5A-8511
					5 m		D5A-8512
				Connector	3 m		D5A-8514
					5 m		D5A-8515
Bevel plunger				Prewired	3 m		D5A-9511
					5 m		D5A-9512
				Connector	3 m		D5A-9514
					5 m		D5A-9515

Specifications

■ RATINGS

Contact output models	10 mA at 24 VAC, 10 mA at 12 VDC
Solid-state output models	100 mA at 5 to 24 VDC±10% Leakage current: 0.15 mA max. Residual voltage: 3 V max. Power consumption: 3 mW max.

■ CHARACTERISTICS

Degree of protection	D5A-1□, D5A-2□: IP40 Other than the above models: IP67
Repeat accuracy (See Note 2.)	M5 (D5A-1□□□ series), M8, slim type: 1 μm max. M5 (D5A-2□□□ series), M16, limit type: 3 μm max.
Life expectancy (See Note 3.)	Mechanical: 10,000,000 operations min. Malfunction: 1,000,000 operations min. (under rated load)
Deviation in electrical life expectancy after 1,000,000 operations	M5, M8, M16, slim type: 10 μm max. Limit type: 20 μm max.
Operating speed	1 μm to 0.5 m/s
Rated frequency	50/60 Hz
Insulation resistance	100 MΩ min. (at 250 VDC) between each terminal and ground
Contact resistance	800 mΩ max. (initial) with 1 m cable, 2.4 Ω max. (initial) with 3 m cable, 4 Ω max. (initial) with 5 m cable)
Dielectric strength	1,000 VAC, 50/60 Hz for 1 min between each terminal and ground
Vibration resistance	Malfunction: 10 to 55 Hz, 1.5-mm double amplitude
Shock resistance	Mechanical: 1,000 m/s^2 min. Malfunction: 300 m/s^2 min.
Temperature coefficient (See Note 4.)	M5, M8, slim type: ±20 x 10^{-6}/°C max. M16 type: ±40 x 10^{-6}/°C max. Limit type: ±50 x 10^{-6}/°C max.
Ambient temperature	Operating: −20°C to 75°C (−4°F to 167°F) with no icing
Ambient humidity	Operating: 30% to 85% (30% to 95% with the seal rubber)

Note: 1. The above figures are initial values.
2. Contact your OMRON sales representative for measurement conditions of the repeat accuracy.
3. Life expectancy values are calculated at an operating temperature of 5°C to 35°C, and an operating humidity of 40% to 70%. Contact your OMRON sales representative for more detailed information on other operating environments.
4. The value indicates the operating position change rate for a change of 1°C in the ambient temperature.

■ OPERATING CHARACTERISTICS

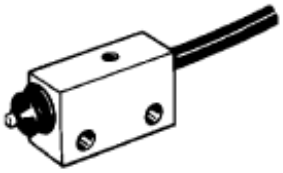
Model	D5A-1100 D5A-2100 (See Note 2.)	D5A-1200 D5A-2200 (See Note 2.)	D5A-3200 D5A-3210 (See Note 2.)	D5A-3300 D5A-3310 (See Note 2.)	D5A-5210 (See Note 2.)	D5A-5310 (See Note 2.)
OF max.	0.29 N	0.49 N	0.49 N	0.98 N	0.49 N	0.98 N
OT min.	1.5 mm	1.5 mm	1.5 mm	1.5 mm	1.5 mm	1.5 mm
MD max.	5 μm	5 μm	5 μm	5 μm	5 μm	5 μm
OP (See Note 1.)	(2 mm)	(2 mm)	(6.5 mm)	(6.5 mm)	10.5±0.4 mm	10.5±0.4 mm

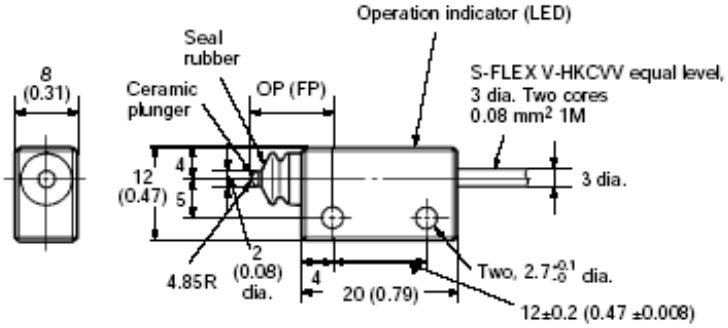
Model	D5A-7400/-7410 D5A-7403/-7413	D5A-8511/-8514 D5A-8512/-8515	D5A-9511/-9514 D5A-9512/-9515
OF max.	2.45 N	3.93 N	
PT max.	1 mm	1 mm	
OT min.	2 mm	5 mm	4 mm
MD max.	5 μm	5 μm	5 μm
OP	(4.4 mm)	21.0±0.4 mm	15.2±0.4 mm
FP	(5 mm)	(21.8 mm)	(15.8 mm)

Note: 1. The operating position of these types is the same as the free position because of high sensitivity (repeat accuracy: 1 μm max.).
2. Total movement is 1.9 to 2.1 mm. Set the appropriate stroke (plunging depth) to 1.0 to 1.5 mm from the FP.

■ SLIM TYPE (SOLID-STATE OUTPUT)

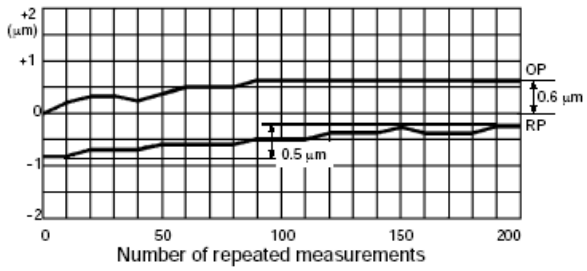
D5A-5210, D5A-5310





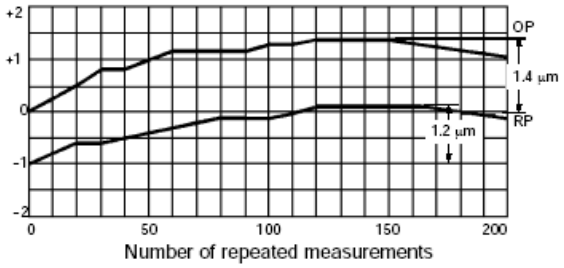
Slim Type (Solid-state Output) with Repeat Accuracy of 1 μm max.

D5A-5□□□ Series



Limit Type (Solid-state Output) with Repeat Accuracy of 3 μm max.

D5A-8□□□ Series, D5A-9□□□ Series



B. Resultats addicionals de l'anàlisi amb elements finits

B.1. Cilindrat: estat de deformacions

A continuació s'exposen les imatges referents a l'estat de deformacions i tensions que no es mostren a la memòria del projecte.

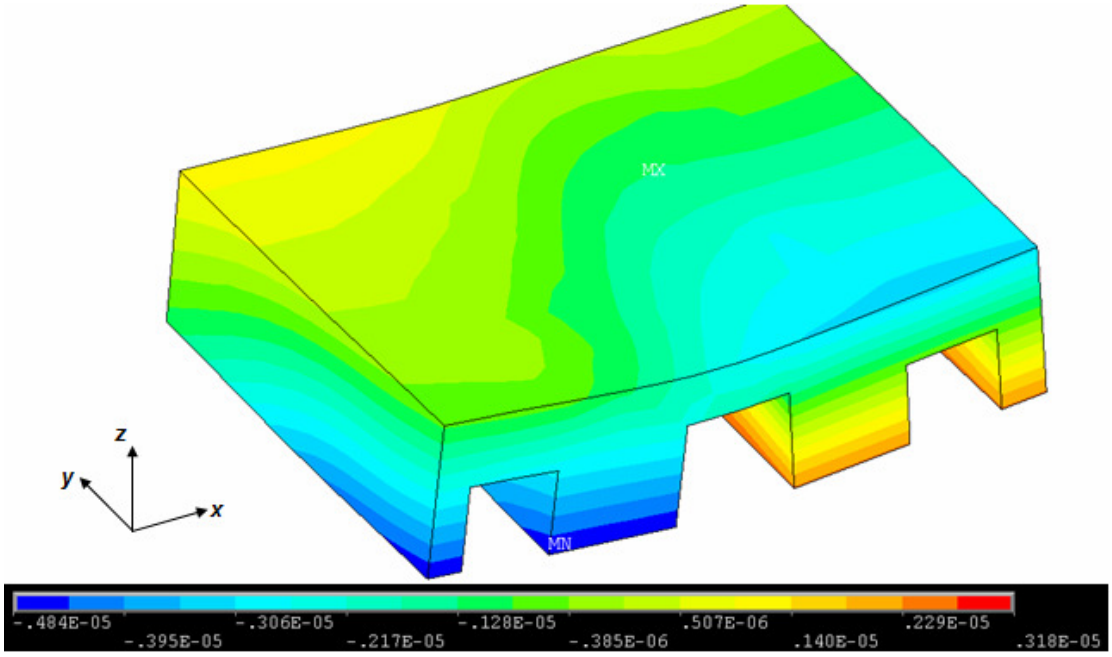


Figura B.1. Deformacions en direcció *x* [m]

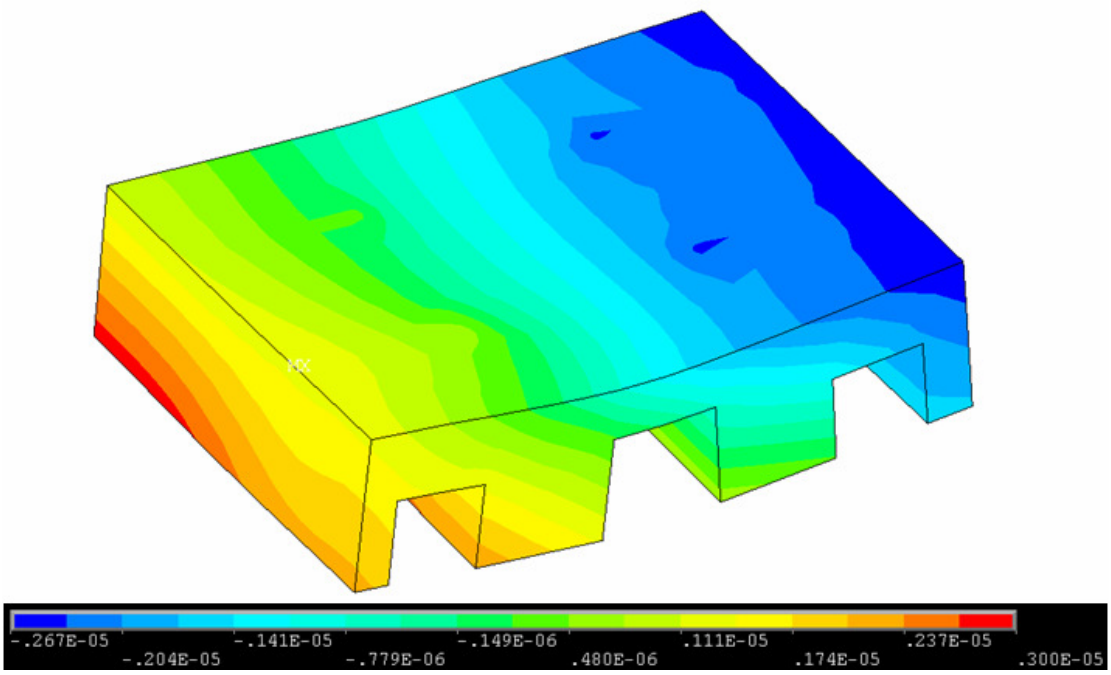


Figura B.2. Deformacions en direcció *y* [m]

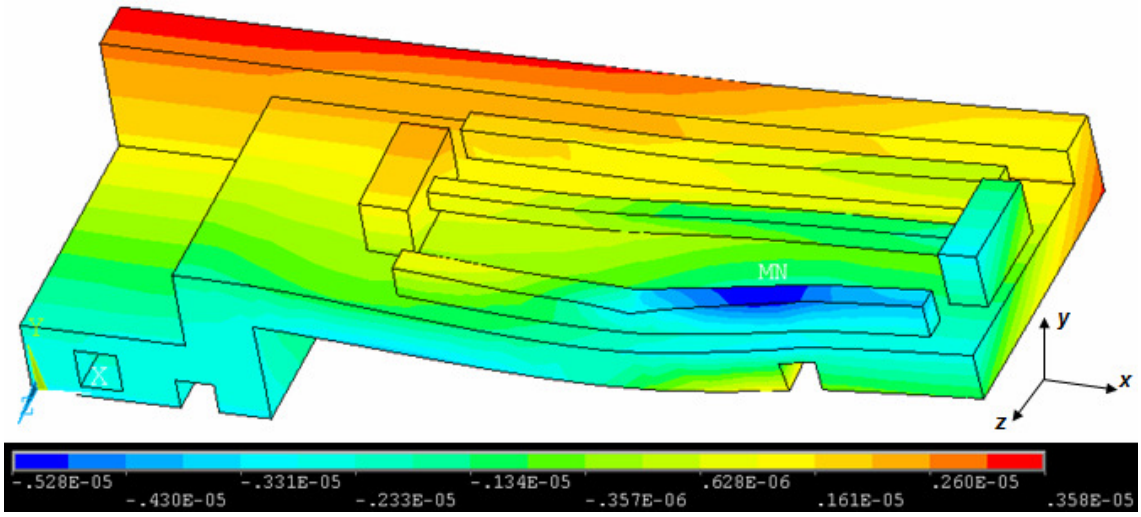


Figura B.3. Deformacions del carro inferior en direcció *x* [m]

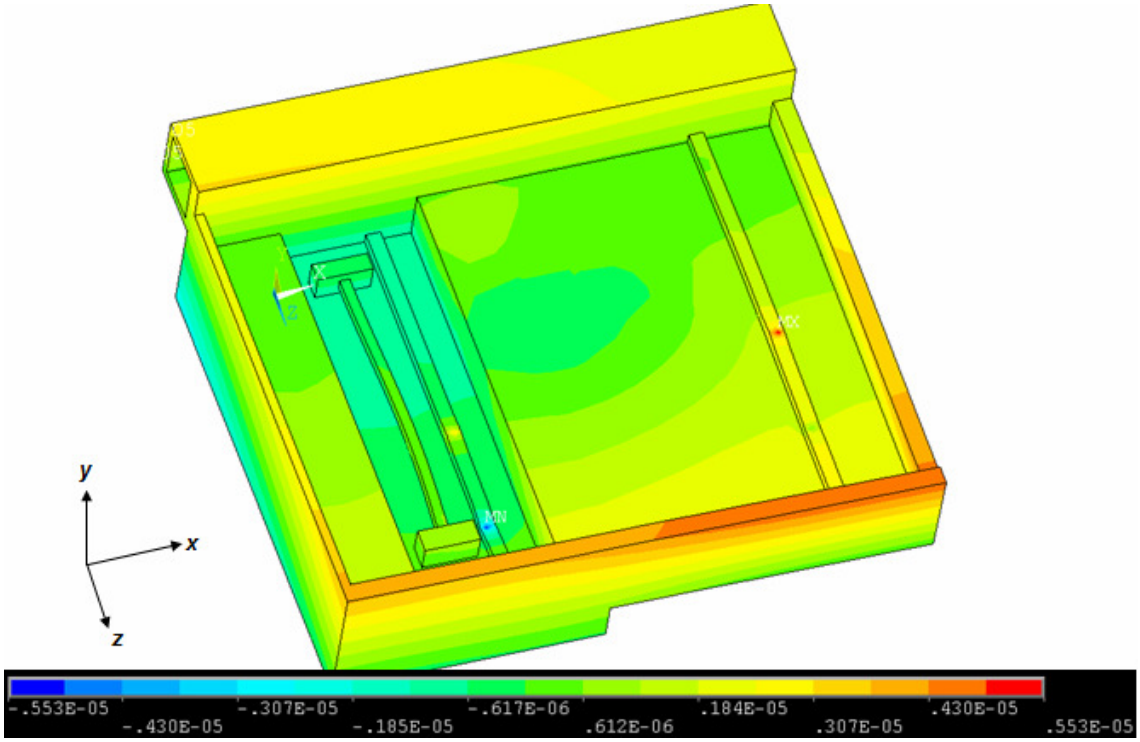


Figura B.4. Deformacions de la bancada en direcció *x* [m]

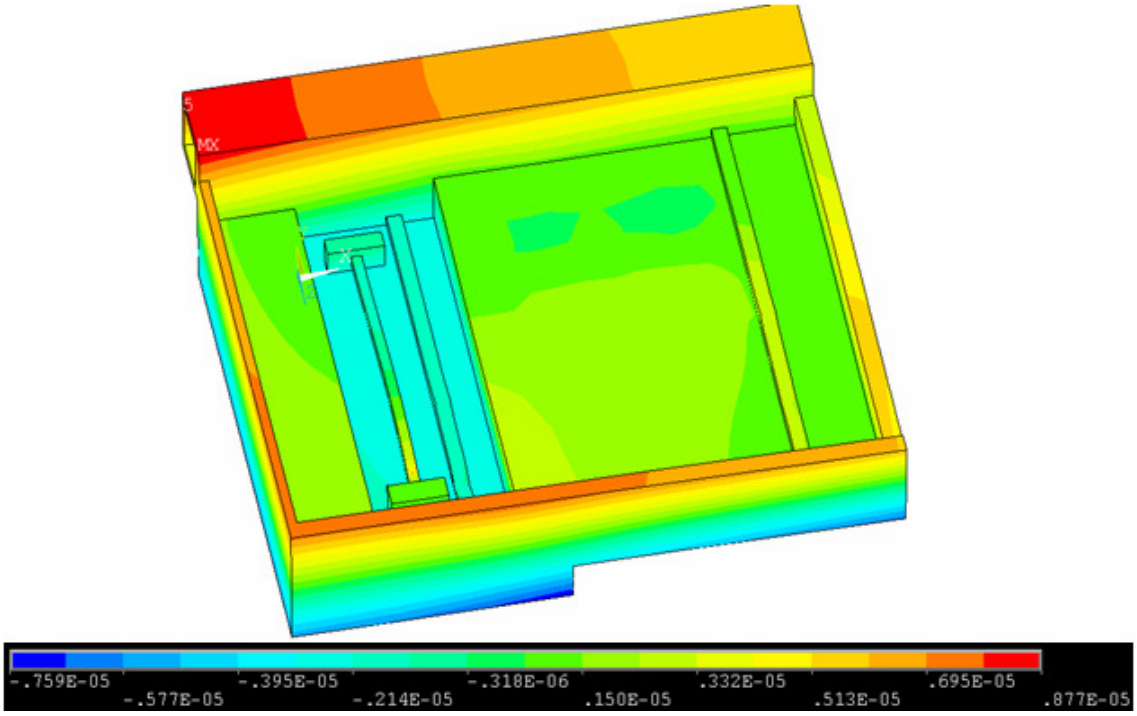


Figura B.5. Deformacions de la bancada en direcció *z* [m]

B.2. Trepat: estat de deformacions i tensions

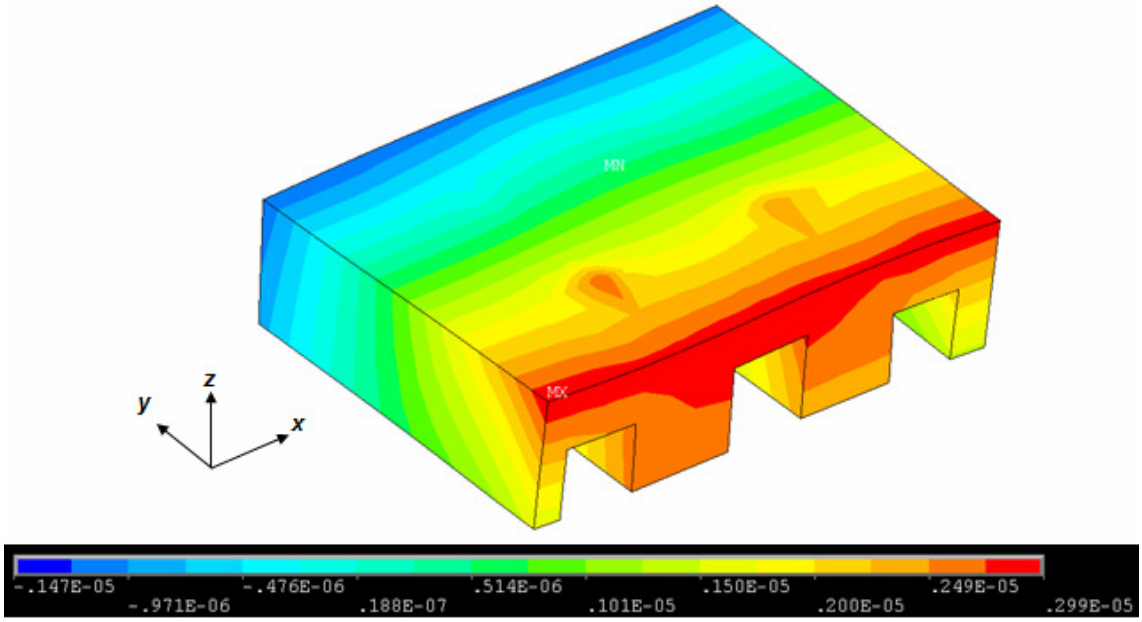


Figura B.6. Deformacions del carro superior en direcció *x* [m]

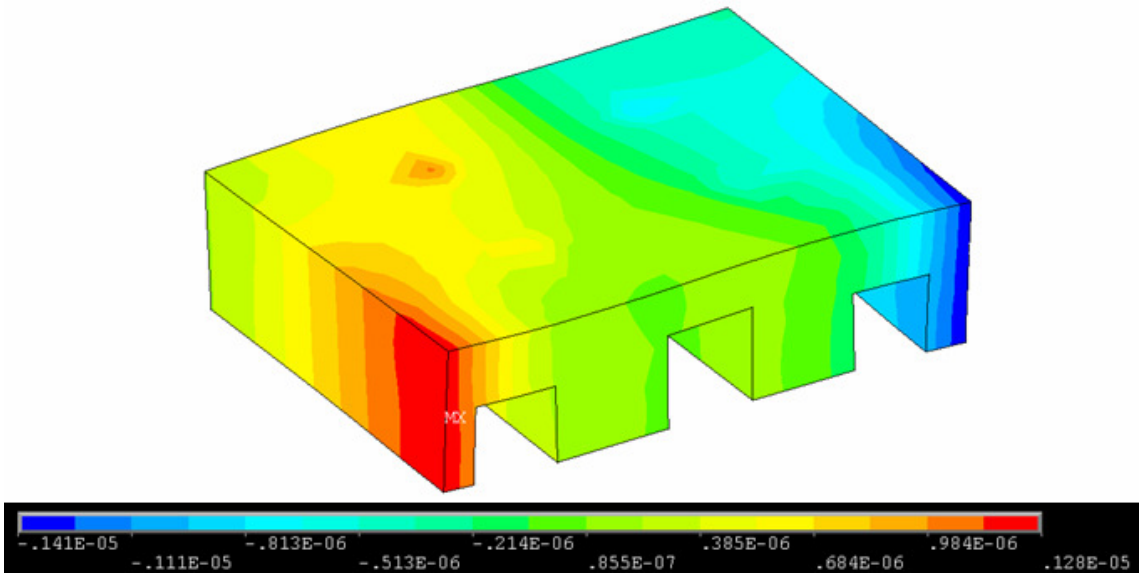


Figura B.7. Deformacions en direcció *z* [m]

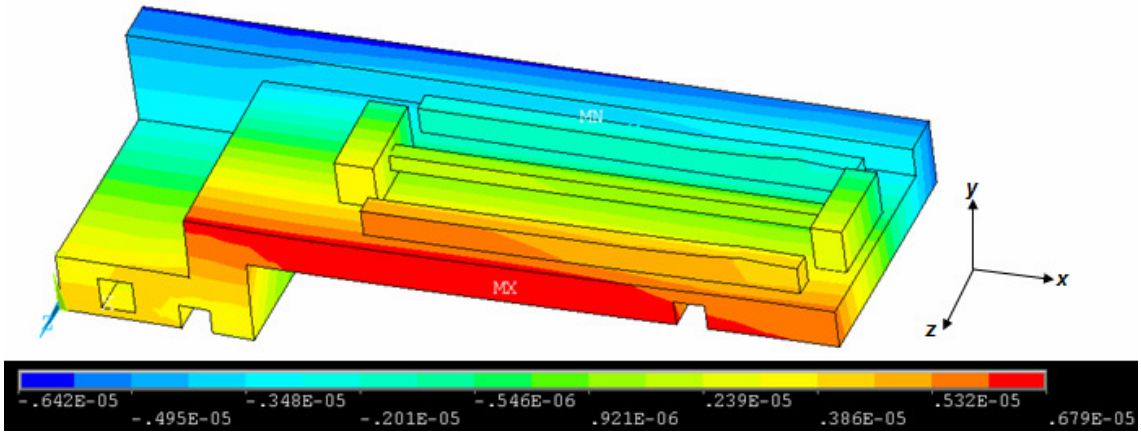


Figura B.8. Desplaçaments en *x* durant el trepat [m]

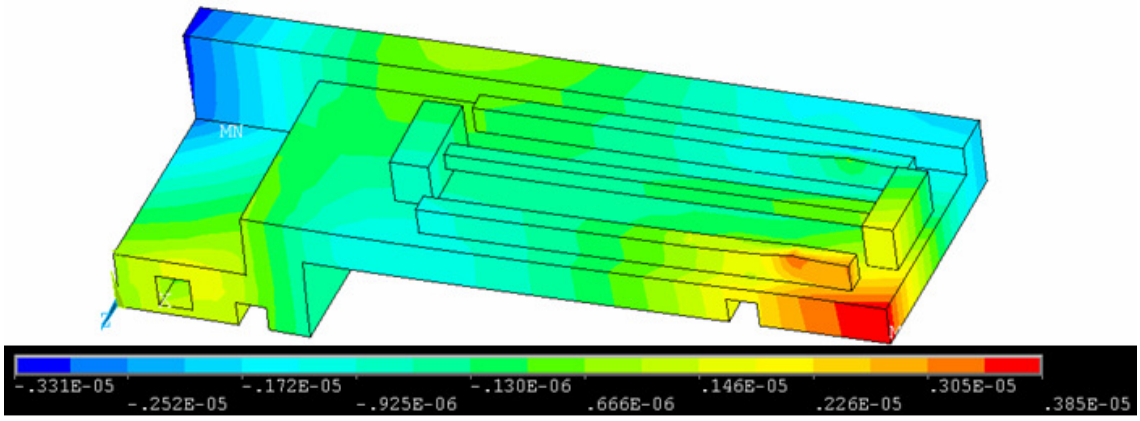


Figura B.9. Desplaçaments en *y* [m]

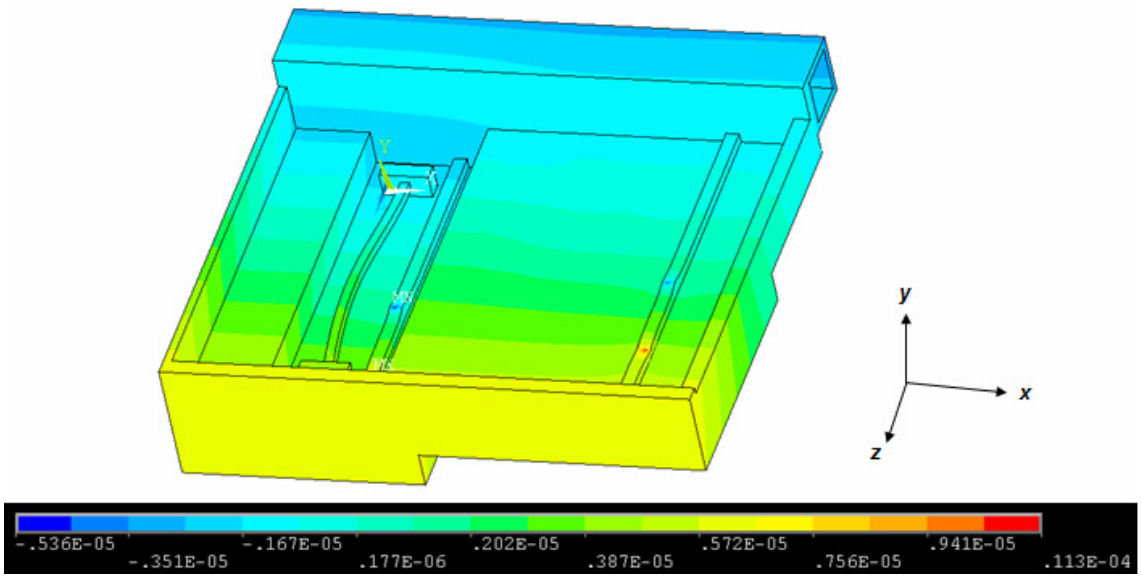


Figura B.10. Deformacions en *x* [m]

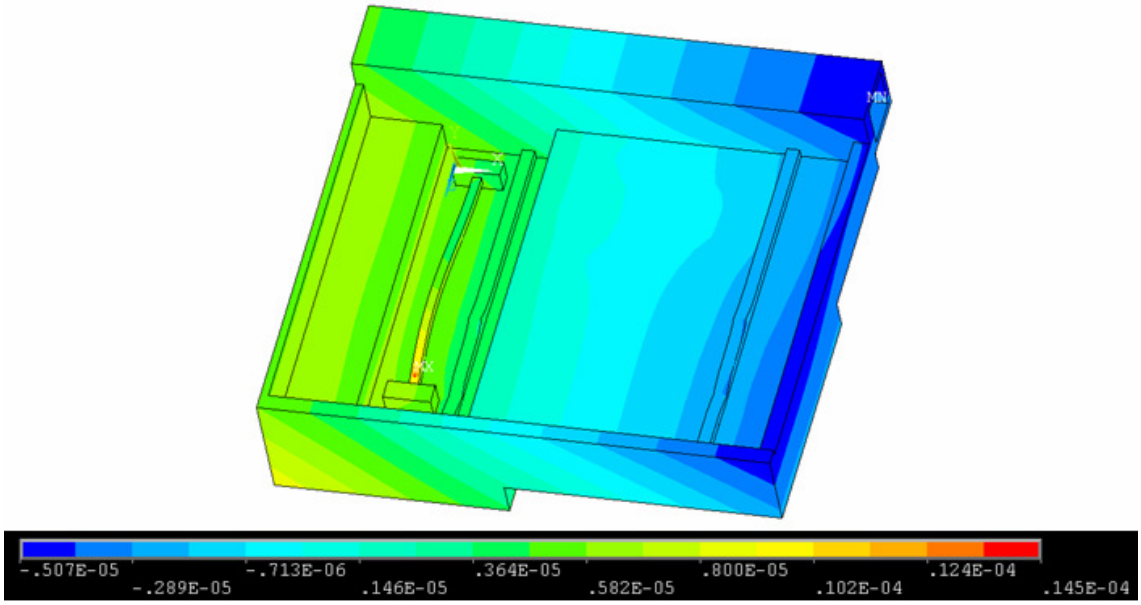


Figura B.11. Deformacions en *z* [m]

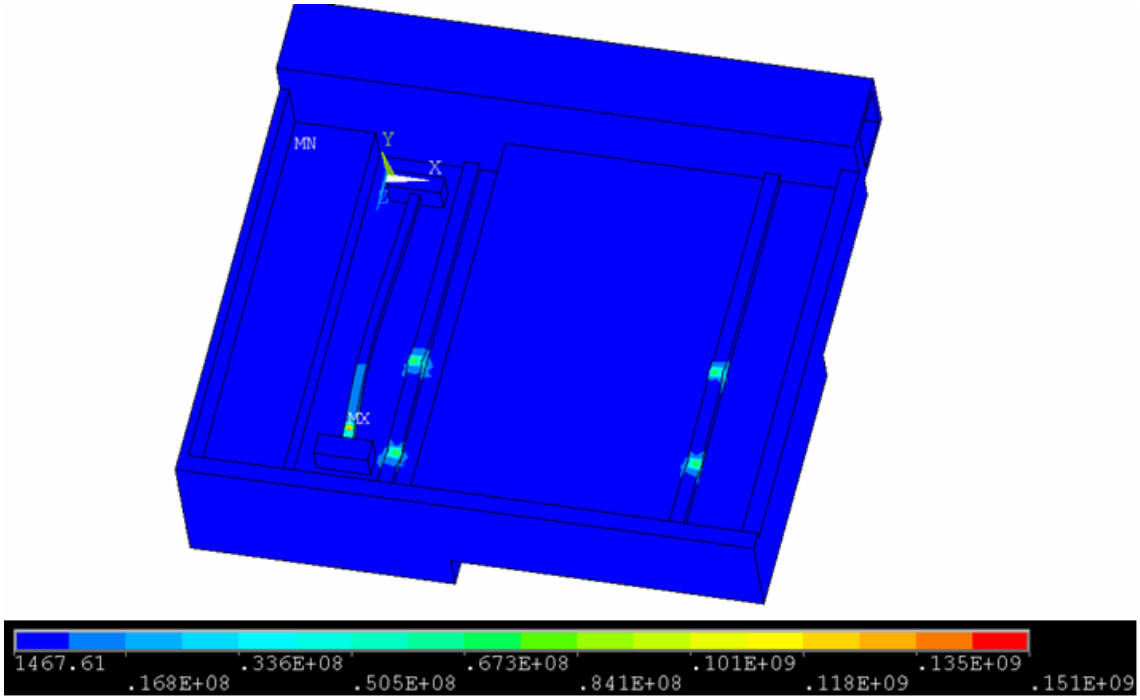


Figura B.12. Tensió de von Mises de la bancada [N·m^{-2}]